F-16-1

DRAFT ENVIRONMENTAL IMPACT STATEMENT ON THE PROPOSED INTRODUCTION OF FORAGE FISH INTO FORT PECK RESERVOIR

Montana Department of
Fish, Wildlife and Parks
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Contents

I. PURPOSE

Current data to evaluate forage fish abundance and reproduction in Fort Peck Reservoir indicate a substantial decline in emerald shiner numbers since 1977 and a general reduction in yellow perch abundance; other forage minnow species also appear to be relatively scarce. A similar situation exists in the other large Missouri River mainstem reservoirs located in North and South Dakota. Spottail shiners (Notropis hudsonius) were introduced into Fort Peck from Lake Oahe in South Dakota during the summer of 1982. The potential positive contribution of this species as a forage fish will be confined primarily to the shallow, shoreline areas of the reservoir.

In order to develop a forage base able to utilize the deeper bottom and open water zones, an additional species of fish is required. The Department of Fish, Wildlife and Parks therefore proposes to introduce the cisco (Coregonus artedii) to fill this role in Fort Peck Reservoir.

II. DESCRIPTION OF PROJECT

Introduction and establishment of a self-sustaining population of cisco will be achieved by taking eggs from populations in other states. Eggs will be transported to an appropriate hatching facility and the young stocked as fry. Some fingerling rearing and release may be attempted. Introduction localities will be determined by the suitability of the site for potential reproduction.

III. DESCRIPTION OF EXISTING AQUATIC ENVIRONMENT

Fort Peck Reservoir is a 40-year old impoundment located in the upper Missouri River Basin in northeastern Montana and is the largest body of water in the state. The multiple purpose uses of the project are flood control, navigation, and hydroelectric power. Other uses include water supply, water quality control, recreation and fisheries. The State of Montana has classified the reservoir as suitable for domestic water supply, swimming, and other water-based recreation. Morphometric data pertinent to Fort Peck Reservoir are listed below in Table 1.

TABLE 1
PERTINENT MORPHOMETRIC DATA

Normal Operating Pool*	2,246 MSL **
Storage	17,900,000 ac. ft

Surface Area	240,000 surface acres
Average Depth	76 feet
Maximum Depth	220 feet
Average Annual Inflow	9,900 cfs
Theoretical Water Exchange Rate	635 days
Shoreline Length	1,520 miles
Length	135 miles
Average Width	3 miles
Average Annual Fluctuations Since 1966	9 feet

* Pertinent data based on this elevation.
**MSL - mean sea level.

This reservoir is classified as dimictic, that is, freely circulating in the spring and fall, directly stratified during the summer and inversely stratified during the winter. Nutrient concentrations in the lake waters indicate that Fort Peck is in the meso-eutrophic range in terms of phosphorus concentrations. The available data on this reservoir indicate that water quality is excellent, although visual observations and chemical data indicate that some degradation may be occurring.

There are two major tributaries to Fort Peck Reservoir, the Missouri and Mussellshell rivers, and a myriad of minor tributaries of which Big Dry Creek is considered most important from the fisheries standpoint. Annual sediment inflow from these streams is estimated to be around 17,500 acre feet.

Forty-two species of fish are presently in Fort Peck Reservoir, of which 13 have been introduced since the formation of the reservoir (Table 2).

TABLE 2
A LIST OF FISHES FOUND IN FORT PECK RESERVOIR

	Common Name	Scientific Name
1.	Pallid sturgeon	Scaphirhynchus albus
2.	Shovelnose sturgeon	Scaphirhynchus platorhynchus
3.	Paddlefish	Polyodon spathula
4.	Goldeye	Hiodon alosoides
5.	Mountain whitefish	Prosopium williamsoni
6.*	Coho salmon	Oncorhynchus kisutch
7.*	Kokanee	Oncorhynchus nerka
8.*	Rainbow trout	Salmo gairdneri
9.*	Brown trout	Salmo trutta
10.*	Lake trout	Salvelinus namaycush
11.*	Northern pike	Esox lucius
12.	Carp	Cyprinus carpio
13.	Flathead chub	Hybopsis gracilis
14.	Lake chub	Couesius plumbeus
15.	Emerald shiner	Notropis atherinoides

16.* Spottail shiner	Notropis hudsonius
17. Sand shiner	Notropis stramineus
18. Brassy minnow	Hybognathus hankinsoni
19. Plains minnow	Hybognathus placitus
20. Silvery minnow	Hybognathus nuchalis
21. Fathead minnow	Pimephales promelas
22. Longnose dace	Rhinichthys cataractae
23. River carpsucker	Carpiodes carpio
24. Blue sucker	Cycleptus elongatus
25. Smallmouth buffalo	Ictiobus bubalus
26. Bigmouth buffalo	Ictiobus cyprinellus
27. Shorthead redhorse	Moxostoma macrolepidotum
28. Longnose sucker	Catostomus catostomus
29. White sucker	Catostomus commersoni
30.* Black bullhead	Ictalurus melas
31. Channel catfish	Ictalurus punctatus
32. Stonecat	Noturus flavus
33. Burbot	Lota lota
34. Plains killifish	Fundulus kansae
35.* Bluegill	Lepomis macrochirus
36.* Smallmouth bass	Micropterus dolomieui
37.* White crappie	Pomoxis annularis
38.* Black crappie	Pomoxis nigromaculatus
39. Yellow perch	Perca flavescens
40. Sauger	Stizostedion canadense
41.* Walleye	Stizostedion vitreum
42. Freshwater drum	Aplodinotus grunniens

*Introduced

IV. EVALUATION OF ENVIRONMENTAL IMPACT

A. Environmental Impact of Proposed Action

The successful introduction of cisco into Fort Peck Reservoir may have some significant positive results. No similar transplants of this species are known to have been made, so that anticipated consequences of the introduction must be evaluated on the basis of less direct information. The following accounts of life history, transplant experience, etc., have been compiled from a variety of sources that are included in the bibliography.

The cisco is broadly distributed throughout the northcentral United States and central Canada. Although large stream and even estuarine populations exist in Canada, the vast majority of cisco stocks are confined to cool or cold water lakes. They are typically associated with cool water temperatures and may descend to considerable depths during warm periods. The primary ecological associations of adults are divided among benthic and pelagic zones.

Eggs are deposited on the bottom in late fall, and receive no parental care. Hatching occurs after ice-out in the spring.

Feeding begins at or prior to yolk depletion and concentrates on micro-zooplankters. Food habits change with size to include larger zooplankton and immature insects. First year growth is typically less than 5 inches.

Succeeding years growth reaches a normal maximum of 12 inches. Life spans vary from a maximum of 10 years in the arctic to 6 years in the southern areas of distribution. Sexual maturity in southern populations is achieved at ages 3 or 4.

Feeding behavior of subadults and adults includes both a particulate predatory mode and a filtering, planktivorous mode. The combination allows considerable flexibility in meeting environmental changes.

Spawning takes place in late fall at temperatures of from 35-40F. Spawning aggregations are large, and are typically found in shallow water over a variety of substrates. The spawning period may extend over a 2- to 3-week interval.

Human exploitation of cisco in the southern portion of the range is generally during the spawning period when large numbers are available in shallow waters. These are usually taken by dipnets for sports harvest. Catches of cisco by angling during the winter months may occur. Most inland lake summer harvest is by gill net. Where cisco reach large sizes, they may support a substantial commercial harvest.

Relatively little transplanting of cisco has been attempted. The best documented transfer was in Lake Opeongo, Ontario, and utilized adults.

Positive results of a successful cisco introduction center around its role as a forage fish. The larger predatory species in Fort Peck Reservoir should benefit from an increased availability of prey. Lake trout, walleye, northern pike, burbot, smallmouth bass and, if introduced, Pacific salmon should utilize the cisco as forage. The resultant improved nutritional status of these predators could be reflected in more rapid growth, longer life spans, larger average and maximum sizes, greater numbers and increased reproductive capacities. The extent to which these results will be realized will depend upon the population density and local distribution of cisco in the reservoir.

If the improvements in sports fish populations discussed in the preceding paragraph are achieved, the quality of the sport fishery in Fort Peck Reservoir should undergo considerable improvement. With an increase in the angling quality, the angler participation should increase substantially. Greater numbers of fishermen would have a positive effect on the local economy through their needs for locally provided goods and services.

It is possible that a self-sustaining cisco population in the reservoir would give rise to a population in the dredge cut complex immediately below the dam. Since this area is now heavily utilized by anglers but low in forage fishes, such a population should be a significant positive factor in the dredge cut fishery.

Immediate, cumulative, and secondary impacts, beyond those mentioned above, are not anticipated to be of consequence.

B. Adverse Environmental Effects Which Cannot be Avoided

The establishment of the cisco outside the area in which it is introduced would be undesirable. No suitable habitat for this species exists upstream from Fort Peck Reservoir that would be directly accessible to cisco. It is unlikely that cisco would move upstream far enough to encounter the barriers. Human intervention would be required to assist cisco in ascending the dams and illegal transport would be difficult or impossible. Downstream movements into the dredge cut complex would be benefical. No other downstream environments in Montana would be suitable for this species. It is possible they could become established in Garrison Reservoir in North Dakota, but they would not be likely to be an adverse addition to that fish fauna.

Any introduction of a new fish species carries an inescapable element of risk of disease and parasites. The cisco introduction will utilize eggs treated with bactericide so that the parasite risk is eliminated and the disease potential minimized.

The adverse effects of cisco on existing species are anticipated to be very low. Only three species currently inhabiting Fort Peck Reservoir exploit open water plankton populations. They are paddlefish (Polyodon spathula), emerald shiner (Notropis atherinoides), and goldeye (Hiodon alosoides). Both paddlefish and emerald shiners occupy the warmer, upper layers of the reservoir and would, therefore, come in contact with cisco only during early spring and late fall. Competitive interactions and their consequences would be insignificant. A relatively small proportion of the goldeye population utilizes somewhat deeper areas, at least on occasion. Some competition for food resources could occur between cisco and this portion of the goldeye population. The consequences of the competition are unlikely to be significant for either species.

No discussion of potential impact of cisco on total plankton pop & subsequent effects on other species

A potential negative impact on the existing commercial fishery for goldeye could result if excessive numbers of cisco entered the catch. This is unlikely for several reasons. The cisco distribution will probably be exclusive of the majority of the goldeye most of the time; hence, fishing efforts directed at goldeye are unlikely to take significant numbers of cisco. If commercial activities did harvest large numbers of cisco it would probably be indicative a very high population density in which the loss to the forage base would be superfluous. In that case, the cisco would likely be a more valuable commercial species than the goldeye.

A negative impact could occur if the effect of cisco as a forage fish were to improve angling quality to such an extent that local facilities for services were overcrowded and unable to meet the demand. This is not likely to occur, but would no doubt be rapidly corrected by expanded facilities and services.

C. Alternatives to the Proposed Action

1. Introduce Bonneville cisco. The Bonneville cisco (<u>Prosopium gemmiferum</u>) is a small, deeper water, planktivorous species native to Bear Lake, Utah-Idaho. Its small adult size (about 6 inches), planktivorous food habits, cool water distribution, and ability to reach high population densities make it a potentially valuable forage fish for introduction into Fort Peck Reservoir. It is not the recommended alternative only because no successful transplants have thus far been achieved. At this time the Utah Department of Fish and Game is engaged in an intensive effort to establish Bonnevillle cisco in Flaming Gorge Reservoir. Since many similarities in transplanting techniques and receiving environment exist in comparison to an introduction into Fort Peck Reservoir, it seems prudent to await the success or failure of the Utah effort. The results will be available by 1985 and a decision to proceed or abandon a similar program for Fort Peck can be made in the light of that experience.

2. Introduce rainbow smelt. The rainbow smelt (Osmerus mordax) could be introduced as a forage species into Fort Peck Reservoir. This is not the recommended option for a variety of reasons.

Rainbow smelt are a complex taxonomic assemblage. Recent literature suggests that at least two and possibly three distinct species occur within the native range in the northeastern United States and eastern Canada. The nominal species (Osmerus spectrum) is called the pygmy smelt and occurs naturally in some of the same waters as the rainbow smelt.

Rainbow smelt are represented by both anadromous and landlocked freshwater forms. The original range has been vastly expanded by intentional and inadvertent introductions. Smelt stocked in Crystal Lake, Michigan as an adjunct of a landlocked salmon introduction formed the basis for most of the current introduced populations. The Crystal Lake introduction was made from stocks originating in Green Lake, Maine. Fish from Crystal Lake made their way downstream into Lake Michigan and from there the species spread throughout the Great Lakes. Recent reports of apparently natural dispersal into the Mississippi drainage have documented their occurrence as far south as Louisiana.

Introductions of smelt into the Missouri drainage of North Dakota were made with stock from Lake Superior. These have now spread throughout the Missouri reservoirs at North and South Dakota. Upstream migrants have penetrated the Missouri and Yellowstone rivers in Montana as far as the first major barriers, Fort Peck Dam and Intake Diversion. Clearly, the species is extremely mobile.

The life history of rainbow smelt is rather well-known. Eggs are deposited in early spring over a variety of substrates and receive no parental attention. The adhesive qualities of the egg attach it firmly to the substrate and eggs develop to hatching in a matter of 2 to 3 weeks. Hatchlings are about .2 inches long. First year growth is extremely variable but a length of 2.5-3 inches is common. Young of the year are planktivorous. Growth at later life stages varies widely as a function of the environment inhabited and the nutritional resources available. Maximum sizes attained may range from 2 to 14 inches.

Food habits are extremely variable; the rainbow smelt is an extremely plastic forager. Many populations appear to subsist almost entirely on zooplankton. Other populations utilize greater proportions of macroinvertebrates. Studies have shown a wide variety of fish eggs, larvae, and young-of-the-year to be included in rainbow smelt diet. The most commonly occuring fish item is early life stages of rainbow smelt. Fish predation is discussed in more detail later is this section.

Distribution of smelt outside the spawning season is keyed to water temperature. Preferred water temperatures are below 60 F; thus, during warm seasons smelt are in deeper waters. They are usually associated in large schools in pelagic environments. Smelt are generally confined to still water habitats outside the breeding season, but studies of possible habitation of large rivers with low temperature maxima are lacking.

Sexual maturity in smelt is reached at from 2 to 6 years depending upon the environment and possibly the genetic stock. Males appear to mature younger than females, which grow to larger sizes and live longer than males. Gonadal maturation takes place in early spring and spawning runs into tributary streams may begin before ice out. Actual spawning occurs over a 2-3 week period when water temperatures exceed 40F. Spawning sites are generally in streams over a variety of bottom materials but lake shoreline spawning is common and successful. Where only short stream reaches are accessible, smelt enter the streams at low light intensities in the afternoon, spawn during the hours of darkness and drift downstream to spend daylight hours in the lake. Postspawning mortality may be extensive.

Smelt are desirable food fish and, where populations are large and individuals reach greater lengths, are typically the objects of both commercial and sports harvest. Commercial catches in inland waters are usually taken by small mesh gill nets, although some trawl fisheries have been attempted. The sport harvest is chiefly taken by hook and line ice fishing and by seine or dipnet during spawning runs. Commercial prices are usually low and the market is frequently glutted.

Predation on smelt by predatory fish is extensive. Since the distribution of smelt is restricted by temperature preference, the predators most in contact with them are those which share their temperature requirements. Pelagic predators seem to be most effective in exploiting the smelt as forage.

A single disease and parasite of smelt are of particular concern for smelt transplants. East coast stocks of rainbow smelt are frequently infected by a viral disease know as piscine erythrocytic necrosis (perhaps identical to a disease know on the west coast as viral erythrocytic necrosis). It is not known with certainty that this pathogen occurs in fresh water populations. In marine environments it infects a wide variety of fish species and in the west coast form may be very serious. Since no adequate means of disinfection of viral pathogens exists, transplant stocks should be taken from uninfected stock.

A microsporidan parasite, Glugea hertwigi, is widely distributed in smelt populations. It is not known to affect other species but is a serious factor for smelt. Consequences of sublethal infections are reduced fecundity and perhaps decreased vigor. Several instances of massive smelt die-offs have been attributed to Glugea infestations. Introductions can be free of Glugea infestation if eggs are used, since disinfection is simple with this life history stage.

The issue of piscivority in rainbow smelt is critical, since its potential value as a forage fish for introductions must be evaluated as a function of its possible negative impacts. The difficulty in assessing the extent and effect of predation on fish by smelt is compounded by the rapidity of digestion (less than 24 hours under some circumstances) that renders stomach content analysis unreliable. The fact that the major period of fish ingestion occurs during winter when sampling is difficult due to temperature and ice further compounds the problem. It seems safe, however, to state that rainbow smelt will eat fish eggs, larvae and young-of-the-year when the opportunity occurs. The potential negative impacts on other species due to smelt predation must be seen as a function of the distribution of smelt and the potential prey. Species with early life history stages physically separated from larger smelt by environmental factors are unlikely to be preyed upon. Those fishes whose early life history environments overlap the distribution of large smelt will probably be negatively affected.

Another aspect of species interactions that is of great concern with smelt introduction evaluation is competition. Rainbow smelt are exceedingly effective competitors with other fish species sharing their food resources. Although the available information is not conclusive, the consensus is that rainbow smelt have exerted a significant suppressory influence on a variety of competitors. The only planktivorous species in the Great Lakes that does not appear to have been affected is the alewife. Alewives seem to be able to compete successfully with smelt and deny them a major portion of the food resource. Whether the smelt have been able to reduce population levels of a variety of species by predation, competition or a combination of both is unclear.

Genetic variability in the rainbow smelt is wide. As mentioned earlier in this section, it has been suggested that the currently recognized species may be separable into two or even three distinct species. The level of taxonomic distinction is of little consequence for forage fish management. The realities of differing ecological requirements and abilities are extremely important. The two better known forms, rainbow and pygmy smelt, are considerably different in their potential impacts as forage fish. The rainbow smelt is a larger form, more predacious, more mobile, and later maturing.

Pygmy smelt reach an average maximum size of less than 5 inches while rainbow smelt are typically 7 inches or more at maximum size. Pygmy smelt are, therefore, available to smaller predators over a longer period. The limited food habits studies available show pygmy smelt to be much more restricted in their food intakes than rainbow smelt. Pygmy diet is almost entirely plankton, an observation consistent with the greater numbers of gill rakers in this form which improve its plankton filtering ability. The planktivorous food habits make pygmy smelt introduction a much reduced risk in terms of predation on other species. Pygmy smelt are not known to engage in the long distance spawning movements that are recorded for rainbow smelt, hence, their spread from an introduction locality may be somewhat less. Age at sexual maturity is 2 years for pygmy smelt and three years for rainbow smelt. A quicker generation time is a desirable characteristic for a forage species. It seems clear that any forage fish introduction utilizing smelt should be made with the pygmy form. Not only are the risks lower but the positive results are likely to be greater than with the rainbow smelt.

The decision as to the introduction of any genetic stock of rainbow smelt into Fort Peck Reservoir is complex. The introduction of smelt into the Missouri reservoirs of North Dakota and the apparent positive effect of the species on sport fish there has created considerable interest in stocking smelt in Fort Peck. The difficulty in accepting the situation in North Dakota as definitive lies in the relative newness of the situation. The smelt have been in Garrison Reservoir for about 10 years. Most of the literature regarding ecological consequences of exotic fish introductions suggests that a 20-year period is minimal for assessing effects in complex ecosystems.

Of particularly critical significance is the possible negative effects of smelt on paddlefish. Evaluation of negative effects on the paddlefish population of Garrison Reservoir resulting from the smelt introduction there cannot, at present, be used as an indicator of potential results of a smelt plant in Fort Peck Reservoir. The situation in Garrison will require at least 20 years from the date of smelt stocking for the final evaluation to be accurate. Under certain circumstances, this period could be more than 40 years. The length of this period is determined by several factors:

a. The time required for smelt to achieve a relatively stable long-term population level. This could vary from 5 to 15 years.

b. The number of years paddlefish require to achieve sexual maturity. Any negative impact on paddlefish by smelt would be most likely to affect reproductive success. Population data on Garrison Reservoir paddlefish are currently best-known from catch statistics at their spawning sites in Montana. Reproductive failure would, therefore, not be detected until the absent age class failed to enter the angler catch during the spawning run. Since Garrison Reservoir paddlefish do not reach sexual maturity until age 10 for males and 15 for females, a minimum of 12 years would elapse before any impact would be detectable.

c. The length of time before repeated year class failures would cause a significant reduction in total numbers of spawning paddlefish. Average age of spawning paddlefish from Garrison Reservoir is about 15 years. Thus, in the most extreme case, if calamitous reproductive failures were to occur every year after smelt population stabilization, at least 3 years would pass after the anticipated date of entry of the affected year classes into the fishery before angler catch rates declined by 50%. It is likely that this level of populated reduction would be required to be noticed. If year class failures were moderate or not uniform through time, an even longer period would be required until spawning population numbers declined significantly. This could easily be 15 years.

Clearly, the effect of smelt introduction on Garrison Reservoir paddlefish cannot be assessed for many years.

Fort Peck Reservoir supports the only major population of paddlefish whose complete life history is within the state. This population supports a substantial fishery and is a state resource of national significance. It seems unwise to take an action with potentially negative consequences for paddlefish before the results of the Garrison smelt stocking are evaluated, particularly in the light of the level of anticipated benefits.

Anticipated results of smelt stocking on the Fort Peck population of naturally reproducing lake trout are deleterious. While smelt provide good quality forage for the larger lake trout, it appears that they have major negative impacts on early life history stages. Among states having lake trout and smelt experience, the consensus seems to be not to introduce smelt into lakes with self-sustaining lake trout. Owing to the limited spawning environment available to Fort Peck lake trout, it is possible that smelt could eliminate natural reproduction by predation and competition.

In the preceding discussion of smelt life history, mention was made of its suppressory effects on a variety of species. In Fort Peck Reservoir, it is likely that an established smelt population would reduce the population levels of goldeye, emerald shiner, bigmouth buffalo, white crappie, black crappie, and yellow perch in addition to the negative effects on paddlefish and lake trout previously discussed. Kokanee plantings would be of reduced success if smelt were present. Cisco populations would be severely reduced if present before a smelt introduction and difficult or impossible to establish if smelt were already abundant. These effects would result from both predation and competition by smelt.

The ability of smelt to colonize areas outside the locality of introduction is a serious negative characteristic of the species as a potential forage fish. This ability is particularly critical in Fort Peck since such a vast river system would be available for upsteam dispersal. Since Garrison Reservoir smelt are now reaching Fort Peck Dam, it is reasonable to assume that establishing them in the reservoir would result in their movement upstream to the first impassable barrier. The unassisted upstream dispersal might extend to Morony Dam on the Missouri, to Tiber Dam on the Marias, and throughout the drainage of the Teton, Judith, and Musselshell rivers. No habitat above Fort Peck Reservoir and below the dams mentioned is known to be suitable for smelt on a year-round basis. The most significant threat lies in the potential for illegal transfer above Morony Dam. A relatively simple series of unauthorized transplants could give smelt access to the prime trout environments in the upper Missouri reservoirs and the river itself. It is extremely unlikely that the establishment of smelt in these localities would be beneficial to trout. It must be emphasized that illegal smelt transplants are very simple to execute and almost impossible to control.

An ideal forage species would possess among its population dynamics characteristics a long-term numerical stability. Where forage fish numbers are similar from year to year, the predators are allowed to establish more stable populations, less liable to dramatic changes in numbers through time. The result is a more reliable fishery. Smelt are subject to violent population variations and hence may be a boom or bust resource for the dependent predators. The result is an unstable sport fish population and fishery.

The desirability of any additional forage fish introduction is reduced at present by the current spottail shiner stocking program. It is possible that success of the spottail could meet all forage fish needs in Fort Peck. Additional plants of other forage species should be considered only when the associated risks are very low. Smelt are not a low risk introduction.

The option of introducing smelt is one that now appears unwise. Given the risks inherent with this species and the potentially less dangerous species available as forage fish introductions, the stocking of smelt in Fort Peck Reservoir is not the recommended alternative.

3. Do not introduce any additional forage fish species into Fort Peck Reservoir.

If no attempt were made to establish a new forage fish, no negative impacts would result. The positive effects would also be foregone. Since the apparent deficiency of the food base for predatory sport fishes results in an inadequate fishery, this alternative is not preferred.

The most significant factor limiting the production of sport and forage fishes in the reservoir is water level fluctuations. If the Corps of Engineers were to operate the reservoir in a fashion more appropriate to the needs of the fishery, it is likely no introductions would be necessary.

D. Short-Term versus Long-Term Use

Cisco stocking in Fort Peck would be a long-term use. If successfully established, the species would remain a part of the reservoir fish fauna for the duration of the existence of the water body. No short-term impacts are anticipated due to the low cost and small manpower requirements of the introduction. Long-term impacts are likely to be small and are discussed in detail in Section B.

E. Irreversible and Irretrievable Commitment of Resources

A self-sustaining cisco population would be an irreversible and irretrievable commitment, since no method of controlling or eliminating the population exists.

F. Discussion of Problems and Objection by Other Agencies or the Public

This topic will be appropriate if a final environmental impact statement is required.

V. BENEFITS

The benefit from the introduction of cisco as a forage fish will be an improved nutritional base for a variety of predacious sport fishes. It is anticipated that improved nutritional status will lead to greater numbers of sport fishes as well as increased average and maximum sizes. An expanded population is expected to improve sport fishing quality and thereby attract greater numbers of anglers. Increased use by recreationists will be a benefit to local business in the Fort Peck Reservoir area.

VI. SUMMARY

Low population levels and poor growth rates of some species of sport fish in Fort Peck Reservoir are thought to be the result of an inadequate food supply. The proposed solution to the problem would be the introduction of an additional forage fish species with the ultimate goal of improving sport fishing quality.

Alternatives

Preferred Alternative. The preferred alternative is to introduce cisco (*Coregonus artedii*) into the reservoir and establish a self-sustaining population. The ecological circumstances for a successful introduction are good. The potential beneficial effects of this species are moderate to high and the associated risks are acceptably low.

Deferred Alternative. The Bonneville cisco, (Prosopium gemmiferum), is a planktivorous species reaching maximum size of less than 7 inches. Its native range is restricted to Bear Lake, Utah-Idaho. This species has great potential as a forage fish but no successful transplants have thus far been made. Utah is engaged in an intensive effort to establish this species in Flaming Gorge Reservoir. Until the results of the Utah introduction are available, no action on this alternative is anticipated.

Smelt Alternative. Rainbow smelt, the pygmy race, have some potential as an additional forage species. Despite the apparent success of this species in North Dakota, the bulk of the experience with introductions of smelt elsewhere in the United States suggests that substantial problems may be associated with its introduction. At this time, while the spottail shiner program is only beginning, it seems inadvisable to accept the risks of damage attendant upon a smelt introduction.

No Action Alternative. No forage fish introduction is a viable alternative. Although not preferred, this approach might still be effective if adequate cooperation of the U.S. Army Corps of Engineers were available to control water levels. In the absence of that assistance, the no action alternative would not lead to improvement in sport fishing quality.

VII. Distribution List

A. Civic Groups
Fort Peck Forward
Glasgow Chamber of Commerce

B. Colleges and Universities
Eastern Montana College
Montana Cooperative Fishery Unit
Montana State University
Northern Montana College
University of Montana
Western Montana College

C. Environmental Groups
Conservation Constituency of the Montana Alliance
Defenders of Wildlife
Environmental Information Center
Montana Audubon Council
Montana Chapter of the American Fisheries Society
Montana Wilderness Association
Montana Wildlife Federation
Northern Plains Resources Council

University of Montana Student
Environmental Research Center

D. Federal
Bureau of Land Management (2 addresses)
Bureau of Reclamation
C. M. Russell National Wildlife Refuge (2 addresses)
National Park Service
Soil Conservation Service (2 addresses)
U. S. Army Corps of Engineers
U. S. Fish and Wildlife Service (3 addresses)
U. S. Forest Service

E. Montana State Government
Department of Natural Resources and Conservation
Environmental Quality Council
Governor's Office
Montana Fish and Game Commission
Area Legislators

F. Out-of-State and Provincial Natural Resource Agencies
Alberta Department of Energy and Natural Resources
Manitoba Department of Natural Resources
North Dakota Game and Fish Department
Saskatchewan Department of Tourism
and Renewable Resources
South Dakota Game, Fish, and Parks Department

G. Press
Glasgow Courier
Herald - News
Lewistown News - Argus
Miles City Daily Star
Phillips County News
Ranger Review
Sidney Herald

H. Private
Austin, Ernest
Christensen, Dave
Grasteit, Nephi
Morehouse, Darrell
Negaard, Olaf

I. Sportsmen's Groups
Big Muddy Sportsmens Club
Billings Rod and Gun Club
Cascade Wildlife Association
Circle Rifle Club
Custer Rod and Gun Club
Glasgow Fish and Wildlife Association
Harlem Rod and Gun Club
Havre Rifle and Pistol Club

Hill County Wildlife Association
Lewistown Rod and Gun Club
Lower Yellowstone Outdoors Association
Madison/Gallatin Chapter of Trout Unlimited
Missouri River Chapter of Trout Unlimited
Missouri River Fly Fishers
Montana Council of Trout Unlimited
Prickley Pear Sportsmen Association
Richland County Rod and Gun Club
Southeastern Sportsmen Association
Upper Musselshell Valley Sportsmen Association
West Daniels Gun Club

VIII. Qualifications of Author

This draft environmental impact statement was prepared under contract to the Department of Fish, Wildlife and Parks, Fisheries Division by Dr. Wayne F. Hadley. He received a B. S. in Wildlife Management from Oklahoma State University in 1962. In 1967 he received an M.S. in Zoology and in 1969 a PhD. from the same institution. He did postdoctoral work at the University of Minnesota from 1969-1970. From 1970-1977 he served as an assistant professor in the Biology Department of the State University of New York at Buffalo. Since 1978 he has been a consultant in Helena, Montana. Dr. Hadley has written a number of scientific papers and reports. He is a certified fishery scientist and a life member of the American Fisheries Society.

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#16
F-16-1

ROUGH DRAFT FOR INTERNAL REVIEW

ENVIRONMENTAL IMPACT STATEMENT

FOR

INTRODUCTION OF FORAGE FISH

IN FORT PECK RESERVOIR

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I. PURPOSE

Current data to evaluate forage fish abundance and reproduction in Fort Peck Reservoir indicate a substantial decline in emerald shiner numbers since 1977 and a general reduction in yellow perch abundance; other forage minnow species also appear to be relatively scarce. A very similar situation exists in the other large Missouri River mainstem reservoirs located in North and South Dakota. Spottail shiners (*Notropis hudsonius*) were introduced into Fort Peck from Lake Oahe in South Dakota during the summer of 1982. The potential positive contribution of this species as a forage fish will be confined primarily to the shallow, shoreline areas of the reservoir.

In order to develop a forage base able to utilize the deeper bottom and open water zones an additional species of fish is required. The Department of Fish, Wildlife, and Parks therefore proposes to introduce the cisco (*Coregonus ortedie*) to fill this role in Fort Peck Reservoir.

II. DESCRIPTION OF PROJECT

Introduction and establishment of a self-sustaining population of ciscoes will be achieved by taking eggs from populations in other states. Eggs will be transported to an appropriate hatching facility and the young stocked as fry. Some fingerling rearing and release may be attempted. Introduction localities will be determined by the suitability of the site for potential reproduction.

III. DESCRIPTION OF EXISTING AQUATIC ENVIRONMENT

Fort Peck Reservoir is a 40-year old impoundment located in the upper Missouri River Basin in northeast Montana and is the largest body of water in the state. The multiple purpose uses of the project are flood control, navigation, and hydroelectric power. Other uses include water supply, water quality control, recreation, and fisheries. The State of Montana has classified the reservoir as suitable for domestic water supply, swimming, and other water-based recreation. Morphometric data pertinent to Fort Peck Reservoir are listed below in Table 1.

TABLE 1

PERTINENT MORPHOMETRIC DATA

Normal Operating Pool*	2,246 MSL**
Storage	17,900,000 ac. ft.
Surface Area	240,000 surface ac.
Average Depth	76 feet
Maximum Depth	220 feet
Average Annual Inflow	9,900 cfs
Theoretical Water Exchange Rate	635 days
Shoreline Length	1,520 miles
Length	135 miles
Average Width	3 miles
Average Annual Fluctuations Since 1966	9 feet

*Pertinent data based on this elevation.
**MSL = mean sea level.

This reservoir is classified as dimictic, freely circulating in the spring and fall, directly stratified during the summer and inversely stratified during the winter. Nutrient concentration in the lake waters indicate that Fort Peck is in the meso-eutrophic range in terms of phosphorus concentrations. The available data on this reservoir indicate that water quality is excellent although visual observations and chemical data indicate that some degradation may be occurring.

There are two major tributaries to Fort Peck Reservoir, the Missouri and Musselshell rivers, and a myriad of minor tributaries of which Big Dry Creek is considered most important from the fisheries standpoint. Annual sediment inflow from these streams is estimated to be around 17,500 acre feet.

Forty-one species of fish are presently in Fort Peck Reservoir of which 12 have been introduced since the formation of the reservoir. A list of the fish species that have been collected from Fort Peck is given in Table II.

TABLE II

A LIST OF FISHES FOUND IN FORT PECK RESERVOIR

	Common Name	Scientific Name
1.	Pallid sturgeon	*Scaphirhynchus albus*
2.	Shovelnose sturgeon	*Scaphirhynchus platorynchus*
3.	Paddlefish	*Polyodon spathula*
4.	Goldeye	*Hiodon alosoides*
5.	Mountain whitefish	*Prosopium williamsoni*
6.*	Coho salmon	*Oncorhynchus kisutch*
7.*	Kokanee	*Oncorhynchus nerka*
8.*	Rainbow trout	*Salmo gairdneri*
9.*	Brown trout	*Salmo trutta*
10.*	Lake trout	*Salvelinus namaycush*
11.*	Northern pike	*Esox lucius*
12.	Carp	*Cyprinus carpio*
13.	Flathead chub	*Hybopsis gracilis*
14.	Lake chub	*Couesius plumbeus*
15.	Emerald shiner	*Notropis atherinoides*
16.	Sand shiner	*Notropis stramineus*
17.	Brassy minnow	*Hybognathus hankinsoni*
18.	Plains minnow	*Hybognathus placitus*
19.	Silvery minnow	*Hybognathus nuchalis*
20.	Fathead minnow	*Pimephales promelas*
21.	Longnose dace	*Rhinichthys cataractae*
22.	River carpsucker	*Carpiodes carpio*
23.	Blue sucker	*Cycleptus elongatus*
24.	Smallmouth buffalo	*Ictiobus bubalus*
25.	Bigmouth buffalo	*Ictiobus cyprinellus*

26.	Shorthead redhorse	*Moxostoma macrolepidotum*
27.	Longnose sucker	*Catostomus catostomus*
28.	White sucker	*Catostomus commersoni*
29.*	Black bullhead	*Ictalurus melas*
30.	Channel catfish	*Ictalurus punctatus*
31.	Stonecat	*Noturus flavus*
32.	Burbot	*Lota lota*
33.	Plains killifish	*Fundulus kansae*
34.*	Bluegill	*Lepomis macrochirus*
35.*	Smallmouth bass	*Micropterus dolomieui*
36.*	White crappie	*Pomoxis annularis*
37.*	Black crappie	*Pomoxis nigromaculatus*
38.	Yellow perch	*Perca flavescens*
39.	Sauger	*Stizostedion canadense*
40.*	Walleye	*Stizostedion vitreum*
41.	Freshwater drum	*Aplodinotus grunniens*

*Introduced

IV. EVALUATION OF ENVIRONMENTAL IMPACT

A. Environmental Impact of Proposed Action

The successful introduction of cisco into Fort Peck Reservoir may have some significant positive results. No similar transplants of this species are known to have been made, so that anticipated consequences of the introduction must be evaluated on the basis of less direct information. The following accounts of life history, transplant experience, etc. have been compiled from a variety of sources that are included in the bibliography.

The cisco is broadly distributed throughout the north-central United States and central Canada. Although large stream and even estuarine populations exist in Canada, the vast majority of cisco stocks are confined to cool or cold water lakes. They are typically associated with cool water temperatures and may descend to considerable depths during warm periods. The primary ecological associations of adults are divided among benthic and pelagic zones.

Eggs are deposited on the bottom in late fall, and receive no parental care. Hatching occurs after ice-out in the spring.

Feeding begins at or prior to yolk depletion and concentrates on micro-zooplankters. Food habits change with size to include larger zooplankton and immature insects. First year growth is typically less than five inches.
Succeeding years growth reaches a normal maximum of 12 inches. Life spans vary from a maximum of ten years in the arctic to six years in the southern areas of distribution. Sexual maturity in southern populations is achieved at ages 3 or 4.

Feeding behavior of subadults and adults includes both a particulate predatory mode and a filtering, planktivorous mode. The combination allows considerable flexibility in meeting environmental changes.

Spawning takes place in late fall at temperatures of from 3-5 C. Spawning aggreations are large and are typically found in shallow water over a variety of substrates. The spawning period may extend over a two to three week interval.

Human exploitation of cisco in the southern portion of the range is generally during the spawning period when large numbers are available in shallow waters. These are usually taken by dipnets for sports harvest. Catches of cisco by angling during the winter months may occur. Most inland lake summer harvest is by gill net. Where cisco reach large sizes, they may support a substantial commercial harvest.

Relatively little transplanting of cisco has been attempted. The best documented transfer was in Lake Opeongo, Ontario, and utilized adults.

Positive results of a successful cisco introduction center around it's role as a forage fish. The larger predator species in Fort Peck Reservoir should benefit from an increased availability of prey. Walleye, northern pike, burbot, smallmouth bass and, if introduced, Pacific salmon should utilize the cisco as forage. The resultant improved nutritional status of these predators could be reflected in more rapid growth, longer life spans, larger average and maximum sizes, greater numbers and increased reproductive capacities. The extent to which these results will be realized will depend upon the population density and local distribution of cisco in the reservoir.

If the improvements in sports fish population characterictics discussed in the preceeding paragraph are achieved, the quality of the sports fishery in Fort Peck Reservoir should undergo considerable improvement. With an increase in the angling quality, the angler participation should increase substantially. Greater numbers of fishermen would have a positive effect on the local economy through their needs for locally provided goods and services.

It is possible that a self-sustaining cisco population in the reservoir would give rise to a population in the dredge cut complex immediately below the dam. Since this area is now heavily utilized by anglers but depauperate of forage fishes, such a population should be a significant positive factor on the dredge cut fishery.

B. Adverse Environmental Effects Which Cannot be Avoided

The establishment of the cisco outside the area in which it is introduced would be undesirable. No suitable habitat for this species exists upstream from Fort Peck Reservoir that would be directly accessible to cisco. It is unlikely that cisco would move upstream far enough to encounter the barriers. Human intervention would be required to assist cisco in ascending the dams and illegal transport would be difficult or impossible. Downstream movements into the dredge cut complex would be beneficial. No other downstream environments in Montana would be suitable for this species. It is possible that they could become established in Garrison Reservoir in North Dakota but they would not be likely to be an adverse addition to that fish fauna.

Any introduction of a new fish species carries an inescapable element of risk of disease and parasites. The cisco introduction will utilize eggs treated with bactericide so that the parasite risk is eliminated and the disease potential minimized.

The adverse effects of cisco on existing species are anticipated to be very low. Only three species currently inhabiting Fort Peck Reservoir exploit open water plankton populations. These are paddlefish (Polyodon spathula), emerald shiner (Notropis atherinoides), and goldeye (Hiodon alosoides). Both paddlefish and emerald shiners occupy the warmer, upper layers of the reservoir and would, therefore, come in contact with cisco only during early spring and late fall. Competitive interactions and their consequences would be insignificant. A relatively small proportion of the goldeye population utilizes somewhat deeper areas, at least on occasion. Some competition for food resources could occur between cisco and this portion of the goldeye population. The consequences of the competition are unlikely to be significant for either species.

A potential negative impact on the existing commercial fishery for goldeye could result if excessive numbers of cisco entered the catch. This is unlikely for several reasons. The cisco distribution will probably be exclusive of the majority of the goldeye most of the time, hence fishing efforts directed at goldeye are unlikely to take significant numbers of cisco. If commercial activities did harvest large numbers of cisco it would probably be indicative a very high population density in which the loss to the forage base would be superfluous. Further, in that case, the cisco would likely be a more valuable commercial species than the goldeye.

A negative impact could occur if the effect of cisco as a forage fish were to improve angling quality to such an extent that local facilities for services were overcrowded and unable to meet the demand. This is not likely to occur but would no doubt be rapidly corrected by expanded facilities and services.

C. Alternatives

1. Introduce Bonneville cisco. The Bonneville cisco (Prosopium gemmiferum) is a small, deeper water, planktivorous species native to Bear Lake, Utah-Idaho. It's small adult size, about six inches, planktivorous food habits, cool water distribution, and ability to reach high population densities make it a potentially valuable forage fish for introduction into Fort Peck Reservoir. It is not the recommended alternative only because no successful transplants have thus far been achieved. At this time the Utah Department of Fish and Game is engaged in an intensive effort to establish Bonneville cisco in Flaming Gorge Reservoir. Since many similarities in transplanting techniques and receiving environment exist in comparison to an introduction into Fort Peck Reservoir, it seems prudent to await the success or failure of the Utah effort. The results will be available by 1985 and a decision to proceed or abandon a similar program for Fort Peck can be made in the light of that experience.

2. Introduce rainbow smelt. The rainbow smelt (Osmerus mordax) could be introduced as a forage species into Fort Peck Reservoir. This is not the recommended option for a variety of reasons.

Rainbow smelt are a complex taxonomic assemblage. Recent literature suggests that at least two and possibly three distinct species occur within the native range in Northeastern United States and Eastern Canada. The nominal species (Osmerus spectrum) is called the pygmy smelt and occurs naturally in some of the same waters as the rainbow smelt.

Rainbow smelt are represented by both anadromous and landlocked freshwater forms. The original range has been vastly expanded by intentional and inadvertent introductions. Smelt stocked in Crystal Lake, Michigan as an adjunct of a landlocked salmon introduction formed the basis for most of the current introduced populations. The Crystal Lake introduction was made from stocks originating in Green Lake, Maine. Fish from Crystal Lake made their way downstream into Lake Michigan and from there the species spread throughout the Great Lakes. Recent reports of apparently natural dispersal into the Mississippi drainage have documented their occurrence as far south as Louisiana.

Introductions of smelt into the Missouri drainage of North Dakota were made with stock from Lake Superior. These have now spread throughout the Missouri reservoirs of North and South Dakota. Upstream migrants have penetrated the Missouri and Yellowstone rivers in Montana as far as the first major barriers, Fort Peck Dam and Intake Diversion. Clearly, the species is extremely mobile.

The life history of rainbow smelt is rather well known. Eggs are deposited in early spring over a variety of substrates and receive no parental attention. The adhesive qualities of the egg attach it firmly to the substrate and eggs develop to hatching in a matter of two to three weeks. Hatchlings are about five mm long. First year growth is extremely variable but a length of 60-70 mm is common. Young of the year are planktivorous. Growth at later life stages varies widely as a function of the environment inhabited and the nutritional resources available. Maximum sizes attained may range from 100 to 350 mm.

Food habits are extremely variable; the rainbow smelt is an extremely plastic forager. Many populations appear to subsist almost entirely on zooplankton. Other populations utilize greater proportions of macro-invertebrates. Studies have shown a wide variety of fish eggs, larvae, and young of the year to be included in rainbow smelt diet. The most commonly occuring fish item is early life stages of rainbow smelt. Fish predation is discussed in more detail later in this section.

Distribution of smelt outside the spawning season is keyed to water temperature. Preferred water temperatures are below 60 F; thus during warm seasons smelt are in deeper waters. They are usually associated in large schools in pelagic environments. Smelt are generally confined to still water habitats outside the breeding season but studies of possible habitation of large rivers with low temperature maxima are lacking.

Sexual maturity in smelt is reached at from 2 to 6 years depending upon the environment and possibly the genetic stock. Males appear to mature younger than females which grow to larger sizes and live longer than males. Gonadal maturation takes place in early spring and spawning runs into tributary streams may begin before ice out. Actual spawning occurs over a 2-3 week period when water temperatures exceed 40 F. Spawning sites are generally in streams over a variety of bottom materials but lake shoreline spawning is common and successful. Where only short stream reaches are accessible, smelt enter the streams at low light intensities in the afternoon, spawn during the hours of darkness and drift downstream to spend daylight hours in the lake. Postspawning mortality may be extensive.

Smelt are desirable food fish and, where populations are large and individuals reach greater length, are typically the objects of both commercial and sports harvest. Commercial catches in inland waters are usually taken by small mesh gill nets, although some trawl fisheries have been attempted. The sports harvest is chiefly taken by hook and line ice fishing and by seine or dipnet during spawning runs. Commercial prices are usually low and the market is frequently glutted.

Predation on smelt by predatory fish is extensive. Since the distribution of smelt is restricted by temperature preference, the predators most in contact with them are those who share their temperature requirements. Pelagic predators seem to be most effective in exploiting the smelt as forage.

As a potential species for introduction, as single disease and parasite of smelt are of particular concern. East coast stocks of rainbow smelt are frequently infected by a viral disease known as piscine erythrocytic necrosis (perhaps identical to a disease known on the west coast as viral erythrocytic necrosis). It is not known with certainty that this pathogen occurs in fresh water populations. In marine environments it infects a wide variety of fish species and in the west coast form may be very serious. Since no adequate means of disinfection of viral pathogens exists, transplant stocks should be taken from uninfected stock.

A microsporidan parasite, <u>Glugea hertwigi</u>, is widely distributed in smelt populations. It is not known to affect other species but is a serious factor for smelt. Consequences of sublethal infections are reduced fecundity and perhaps decreased vigor. Several instances of massive smelt die offs have been attributed to <u>Glugea</u> infestations. Introductions can be free of <u>Glugea</u> infestation if eggs are used since disinfection is simple with this life history stage.

The issue of piscivosity in rainbow smelt is a critical one since its potential value as a forage fish for introductions must be evaluated as a function of its possible negative impacts. The difficulty in assessing the extent and effect of predation on fish is compounded by the rapidity of digestion, less than 24 hours under some circumstances, that renders stomach content analysis unreliable, ~~and~~ the fact that the major period of fish ingestion occurs during winter when sampling is difficult due to temperature and ice. It seems, however, safe to state that rainbow smelt will eat fish eggs, larvae and young of the year when the opportunity occurs. The potential negative impacts on other species due to smelt predation must be seen as a function of the distribution of smelt and the potential prey. Species with early life history stages physically separated from larger smelt by environmental factors are unlikely to be preyed upon. Those fishes whose early life history environments overlap the distribution of large smelt will probably be negatively affected.

Another aspect of species interactions that is of great concern with smelt introduction evaluation is competition. Rainbow smelt are exceedingly effective competitors with other fish species sharing their food resources. Although the available information is not one hundred percent conclusive the consensus is that rainbow smelt have exerted a significant suppressory influence on a variety of competitors. The only planktivorous species in the Great Lakes that does not appear to have been affected is the alewife. Alewives seem to be able to compete successfully with smelt and deny them a major portion of the food resource. Whether the smelt have been able to reduce population levels of a variety of species by predation, competition or a combination of both is unclear.

Genetic variability in the rainbow smelt is wide. As mentioned earlier in this section, it has been suggested that the currently recognized species may be separable into two or even three distinct species. The level of taxonomic distinction is of little consequence for forage fish management. The realities of differing ecological requirements and abilities are extremely important. The two better known forms, rainbow and pygmy smelt, are considerably different in their potential impacts as forage fish. The rainbow smelt is a larger form, more predacious, more mobile, and later maturing.

Pygmy smelt reach an average maximum size of less than 5 inches while rainbow smelt are typically 7 inches or more at maximum size. Pygmy smelt are, therefore, available to smaller predators over a longer period. The limited food habits studies available show pygmy smelt to be much more restricted in their food intakes than rainbow smelt. Pygmy diet is almost entirely plankton; an observation consistent with the greater numbers of gill rakers in this form which improve its plankton filtering ability. The planktivorous food habits make pygmy smelt introduction a much reduced risk in terms of predation on other species. Pygmy smelt are not known to engage in the long distance spawning movements that are recorded for rainbow smelt, hence their spread from an introduction locality may be somewhat less. Age at sexual maturity is 2 years for pygmy smelt and 3 years for rainbow smelt. A quicker generation time is a desirable characteristic for a forage species. It seems clear that any forage fish introduction utilizing smelt should be made with the pygmy form. Not only are the risks lower but the positive results are likely to be greater than with the rainbow smelt.

The decision as to the introduction of any genetic stock of rainbow smelt into Fort Peck Reservoir is complex. The introduction of smelt into the Missouri Reservoirs of North Dakota and the apparent positive effect of the species on sports fish there has created considerable interest in stocking smelt in Fort Peck. The difficulty in accepting the situation in North Dakota as definitive lies in the relative newness of the situation. The smelt have been in Garrison Reservoir for about 10 years. Most of the literature regarding ecological consequences of exotic fish introductions suggests that a 20 year period is minimal for assessing effects in complex ecosystems.

Of particularly critical significance is the possible negative effects of smelt on paddlefish. Owing to the long life span (up to 30 years) and late attainment of sexual maturity (10 years) in paddlefish, no negative effects on this species would likely be noted for at least 30 years from the date of smelt introduction. This is occasioned by the major index of paddlefish abundance being taken during spawning runs. If 10 years are allowed as the period necessary for a smelt population to stabilize, and it is assumed that the impact of smelt would be most likely to affect reproduction, then a minimum of 20 years would pass before reproductive failure would be reflected by the failure of the effected year class to appear in the spawning run (10 years to sexual maturity). Since the majority of spawners are in the 15 to 20 year age group, an additional 10 years would elapse before a major shift in spawner numbers would occur. It is, therefore, clear that the effect of smelt introduction on Garrison Reservoir paddlefish cannot be assessed for many years.

Fort Peck Reservoir supports the only major population of paddlefish whose complete life history is within the state. This population supports a substantial fishery and is a state resource of national significance. It seems unwise to take an action with potentially negative consequences for paddlefish before the results of the Garrison smelt stocking is evaluated, particularly in the light of the level of anticipated benefits.

Anticipated results of smelt stocking on the Fort Peck population of naturally reproducing lake trout are negative. While smelt provide good quality forage for the larger lake trout, it appears that they have major negative impacts on early life history stages. Among states having lake trout and smelt experience, the consensus seems to be not to introduce smelt into lakes with self-sustaining lake trout. Owing to the limited spawning environment available to Fort Peck lake trout, it is possible that smelt could eliminate natural reproduction by predation and competition.

In the preceeding discussion of smelt life history, mention was made of its suppressory affects on a variety of species. In Fort Peck Reservoir, it is likely that an established smelt population would reduce the population levels of goldeye, emerald shiner, big-mouth buffalo, white crappie, black crappie, and yellow perch in addition to the negative effects on paddlefish and lake trout previously discussed. Kokanee plantings would be of reduced success if smelt were present. Cisco populations would be severely reduced if present before a smelt introduction and impossible to establish if smelt were already abundant. These effects would result from both predation and competition by smelt.

The ability of smelt to colonize areas outside the locality of introduction is a serious negative characteristic of the species as a potential forage fish. This ability is particularly critical in Fort Peck since such a vast river system would be available for upstream dispersal. Since Garrison Reservoir smelt are now reaching Fort Peck Dam it is reasonable to assume that establishing them in the reservoir would result in their movement upstream to the first impassable barrier. The unassisted upstream dispersal might extend to Morony Dam on the Missouri, to Tiber Dam on the

Marias, and throughout the drainage of the Teton, Judith, and Musselshell rivers. No habitat above Fort Peck Reservoir and below the dams mentioned is known to be suitable for smelt on a year round basis. The most significant threat lies in the potential for illegal transfer above Morony Dam. A relatively simple series of unauthorized transplants could give smelt access to the prime trout environments in the upper Missouri Reservoirs and the river itself. It is extremely unlikely that the establishment of smelt in these localities would be beneficial to trout. It must be emphasized that illegal smelt transplants are very simple to execute and almost impossible to control.

An ideal forage species would possess among its population dynamics characteristics a long term numerical stability. Where forage fish numbers are reasonably similar from year to year, the predators are allowed to establish more balanced populations less liable to dramatic changes in numbers through time. The result is a more reliable fishery. Smelt are subject to violent population variations and hence may be a boom or bust resource for the dependent predators. The result is an unstable sports fish population and fishery.

The desirability of any additional forage fish introduction is reduced at present by the current spottail shiner stocking program. It is possible that success of the spottail could meet all forage fish needs in Fort Peck. Additional plants of other forage species should be considered only when the associated risks are very low. Smelt are not a low risk introduction.

The option of introducing smelt is one that now appears unwise. Given the risks inherent with this species and the potentially less dangerous species available as forage fish introductions, the stocking of smelt in Fort Peck Reservoir is not the recommended alternative.

3. Do Not Introduce Any Additional Forage Fish Species Into Fort Peck Reservoir

If no attempt were made to establish a new forage fish, no negative impacts would result. The positive effects would also be foregone. Since the apparent deficiency of the food base for predatory sports fish results in an inadequate fishery, this alternative is not preferred.

D. Short-Term vs. Long-Term Use

Cisco stocking in Fort Peck would be a long-term use. If successfully established, the species would remain a part of the reservoir fish fauna for the duration of the existence of the water body.

E. Irreversible and Irretrievable Commitment of Resources

A self-sustaining cisco population would be an irreversible and irretrievable commitment since no method of controlling or eliminating the population exists.

F. Discussion of Problems and Objection by Other Agencies or the Public

This topic will be appropriate if a final environmental impact statement is required.

V. BENEFITS

The benefit from the introduction of cisco as a forage fish will be an improved nutritional base for a variety of predaceous sports fish. It is anticipated that improved nutritional status will lead to ~~the~~ greater numbers of sports fishes as well as increased average and maximum sizes. An expanded population is expected to improve sports fishing quality and thereby attract greater numbers of anglers. Increased use by recreationists will be a benefit to local business in the Fort Peck Reservoir area.

VI. Summary

Low population levels and poor growth rates of some species of sports fish in Fort Peck Reservoir are thought to be the result of an inadequate food supply. The proposed solution to the problem would be the introduction of an additional forage fish species with the ultimate goal of improving sport fishing quality.

Alternatives

Preferred Alternatives. The preferred alternative is to introduce cisco (Coregonus artedii) into the reservoir and establish a self-sustaining population. The ecological circumstances for a successful introduction are good. The potential beneficial effects of this species are moderate to high and the associated risks are acceptably low.

Deferred Alternative. The Bonneville cisco, (Prosopium gemmifinum), is a planktivorous species reaching maximum size of less than 7 inches. It's native range is restricted to Bear Lake, Utah-Idaho. This species has great potential as a forage fish but no successful transplants have thus far been made. Utah is engaged in an intensive effort to establish this species in Flaming Gorge Reservoir. Until the results of the Utah introduction are available, no action on this alternative is anticipated.

Smelt Alternative. Rainbow smelt, the pygmy race, have some potential as an additional forage species. Despite the apparent success of this species in North Dakota, the bulk of the experience with introductions of smelt elsewhere in the U.S. suggests that substantial problems may be associated with its introduction. At this time, while the spottail shiner program is only beginning, it seems inadvisable to accept the risks of damage attendent upon a smelt introduction.

No Action Alternative. No forage fish introduction is a viable alternative. Although not preferred, this approach might still be effective if adequate cooperation of the U.S. Army Corps of Engineers were available to control water levels. In the absence of that assistance, the no action alternative would not lead to improvement in sport fishing quality.